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ON THE HABITS OF THE LONG-TAILED FIELD MOUSE.

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PLATE IV.

OF the large and widely-spread genus *Mus*, five species only are known to inhabit the British Islands; the two larger, *M. decumanus* and *M. rattus*, being commonly known as Rats; the rest, *M. musculus*, *M. sylvaticus*, and *M. messorius*, as Mice. A third species of Rat, *M. alexandrinus*, is sometimes brought to our shores by vessels from Egypt and various ports in Southern Europe, but has not at present succeeded in permanently establishing itself. It appears doubtful, however, whether this last is really specifically distinct from *M. rattus*.

Of the latter group, or "mice," the Long-tailed Field Mouse, *Mus sylvaticus*, is the largest, and is very numerous as a species. Though a singularly beautiful little creature, it has a bad reputation both with the farmer and the gardener. No sooner does the sowing season come round and the first early peas are put into the ground, than the Field Mice find them out, and, taking up their abode close by, carry on their depredations during the hours of darkness. From observations made on this species in captivity, I believe it to be more strictly nocturnal in its habits than either the common House Mouse or the Harvest Mouse, *M. messorius*; and the much larger and more prominent eyes seem to indicate the same thing.

The Long-tailed Field Mouse has some little resemblance to the Common Mouse, the chief points of difference being some-

ZOOLOGIST.—JUNE, 1857.

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what analogous to those distinguishing the Hare from the Rabbit; thus both the ears and the hinder limbs are longer, and the general colour of the fur of a warmer tint. The relative difference in size is also about the same, or perhaps rather less: besides which the eyes are much larger and more prominent, the whole head, and especially the muzzle, more elongated, and the tail longer. The dimensions given in Bell's 'British Quadrupeds' are as follows:—Length of the head and body, 3 in. 8 lines; of the head, 1 in. 1 line; of the ears, 7 lines; of the tail, 3 in. 6 lines.

For the sake of comparison, the following measurements, taken from ten adults from this locality, may perhaps be worth recording:—Average length of the head and body, 3 in. 9½ lines; of the tail, 3 in. 5 lines. By far the largest example was a female, the total length of which was 8 in. 2 lines, the head and body occupying 4 in. 6 lines, the tail 3 in. 8 lines. In one instance the tail measured exactly half of the entire length, but its proportionate length, as seen above, was in these examples less than in Bell's table of dimensions. In this respect, indeed, I have found great variation, but need hardly add that in making the above measurements abnormally short-tailed specimens—which might possibly have lost a portion of that appendage—were, of course, excluded.

The upper parts are fawn, interspersed with numerous darker hairs, the general effect being yellowish brown with a slight greyish tinge. Under parts white, with a small patch or streak of fawn between the fore legs. Darkest colour extending along the back from occiput to root of tail, the fawn tint purest where it borders on the white. Posterior margin of hams bright orange-fawn. Feet and fore legs white up to the wrist, the pink skin showing through the soft and somewhat scanty hair on the feet. Hinder feet and legs white up to the hocks, which are dark grey behind, fading into pale fawn next to the white, the white in front being carried up so as to join that of the rest of the under parts of the body. Inner surface and anterior margin of thighs white, the rest of the same colour as the back. All the fur slate-colour at the base. Ears very large, beautifully formed, and sparsely clothed with very short brown hairs. Eyes of great size and remarkably prominent. Whiskers abundant and very long. The hinder feet are large in proportion to the fore feet, the three middle toes long, the claws white. The tail is long and

flexible, brownish grey above, whitish below; rather less than half the entire length of the animal, but varying considerably in this respect. The colour of the upper parts varies in different individuals, some showing but little of the yellow tint. The young are much greyer than the adults. Fatio ('Faune des Vertébrés de la Suisse') states that he has remarked considerable variation in the shape and extent of the yellow pectoral spot in Swiss examples, some having it so produced as to form a complete collar, while in others he has found it entirely absent.

Albinos now and then occur in this country, an instance of which will be found recorded in 'The Field,' Jan. 18th, 1873, by Mr. H. De F. Cox; and in 'The Zoologist,' June, 1884, p. 226, Mr. A. H. Cocks, describing an albino variety picked up dead in the garden of Dropmore Vicarage, near Great Marlow, Bucks, says, "It was a true albino, the eyes being pink; there was the slightest possible tinge of colour on part of the back and flanks. It was a female; and its unusual colour had—from the look of the teats—proved no obstacle to its finding a mate, and becoming the mother of a family." According to Lord Clermont ('Quadrupeds and Reptiles of Europe'), varieties occur of white, brown, and dull yellow, the belly, however, being always white.

The large and well-developed ears appear capable of detecting the slightest sound, and twitch convulsively at a chirp or whistle so faint as to be barely audible to human ears. The sense of smell, too, is probably well developed, and is doubtless the principal guide to the whereabouts of food—accounting for the great readiness with which corn, seed, bulbs, &c., are discovered, whether in the ground or stored in outhouses.

This species, according to my experience of its habits in this neighbourhood, does not, like *M. musculus* and *M. messorius*, inhabit stacks of corn, nor have I ever succeeded in finding a single individual of the Field Vole, *Arvicola agrestis*, either in a granary or a stack of any kind, though the latter animal is said by Bell to frequent such situations. A few may be carried in now and then at harvest time among the sheaves of corn, but must either soon die or else make their escape; for, setting aside rats, the little rodents found often in such immense numbers when the corn is threshed are all (with the exception of a small but varying proportion of Harvest Mice) of one species, viz., *Mus musculus*. Doubtless the habits of this little animal would vary a good deal

according to circumstances, and I ought to add that these observations have been confined to a rather limited area.

The Long-tailed Field Mouse devours corn and pulse of all kinds; also acorns, nuts, bulbs and roots of various sorts; and from Mr. Barrington's interesting account of the habits of this animal in confinement (Zool., April, 1882) it appears that the leaves as well as the roots of certain plants are eaten by it. He says, "The leaves of clover, and especially dandelion, were greatly relished, and for an unexpanded flower of dandelion nearly everything else would be deserted." They also ate arbutus berries, gooseberries, apples, grapes, &c., but almonds were not much liked. One I kept would eat the berries of the butcher's-broom. In a wild state they are particularly fond of carrots. Though abroad and active throughout the year, these mice, as is well known, store up underground during the autumn vast quantities of food for winter use, when the hard frozen ground would otherwise prevent them from obtaining a sufficient supply. For this purpose acorns are often chosen. Prof. Bell mentions also nuts, corn, and various seeds, and even roots, as having been found in their winter hoards. Possibly these supplies are sometimes exhausted before the return of spring; for, like rabbits, they will in severe weather, when the ground is covered with snow, devour the bark of young trees. The last-mentioned writer, in his account of the destruction wrought by mice and voles among young trees in the Forest of Dean and in the New Forest during the years 1813 and 1814, states that among the enormous number of small rodents taken in pitfalls, &c., though the greater part consisted of Field Voles, *Arvicola agrestis*, a considerable number of Long-tailed Field Mice were also caught. The present species, like most of the smaller British rodents, is to a certain extent carnivorous, preying when hard pressed on young birds, &c., and even occasionally on members of its own species. Fatio mentions insects as forming a part of its diet.

This animal breeds several times during the year, beginning as early as March, and continuing till late in the autumn. Mr. Barrington's experiments prove that a pair of these mice are capable, in a state of confinement, of producing as many as four litters in the space of ten weeks. He found the average number of young in nine litters to be four, five being the

maximum; in a wild state, however, the litters are probably larger. From seven to ten is the number stated by Bell, while Fatio gives it as four to six. It seems probable that more than one pair sometimes jointly occupy a burrow, several mice being at times bolted at once when water is poured into a hole. Buffon gives an instance where twenty-two were found in a single hole, *viz.* two females and twenty young. Mr. Barrington estimates the period of gestation to be about three weeks.

Their burrows, which are their usual retreats during the day, and in which the young are born, are to be found in woods, orchards, gardens, hedge-banks, &c.; they are also often made in the open fields, especially where peas or beans have been recently sown, also at harvest time, remaining till the stubbles are ploughed. From the quantity of earth thrown out at one or more of the openings (of which there are seldom less than three) they are often conspicuous objects, looking at a little distance like mole-hills. Old manure-heaps, probably from the warmth generated in them, are favourite spots with these little animals; and they not unfrequently make their abode in sheds and out-houses attached to gardens, where bulbs, seeds, &c., are kept.

The singular tenacity with which the young mice cling to their dam when she is surprised and put to flight was, as far as I am aware, first observed—or at any rate recorded—by the Rev. Gilbert White, the instance on which his attention was drawn to this circumstance occurring during the removal of the lining of a hot-bed. He says, “From out of the side of this bed leaped an animal with great agility, that made a most grotesque figure; nor was it without great difficulty that it could be taken, when it proved to be a large white-bellied Field Mouse, with three or four young clinging to her teats by their mouths and feet. It was amazing that the desultory and rapid motions of this dam should not oblige her litter to quit their hold, especially when it appeared that they were so young as to be both naked and blind!” Fatio witnessed a similar occurrence: a female was ploughed out of the ground with young ones clinging to her, but not, as in the instance given by White, *to the teats*, but “*accrochés par les pieds antérieurs et par les dents à sa queue et à ses poils.*” As regards the manner of attachment, Mr. Barrington’s observations are in accordance with those of the author of the ‘Natural History of Selborne’; for, after remarking that the mothers

seemed to have hardly any cessation of suckling, he says, "So fast did the young attach themselves that the females could scarcely move without pulling two or three after them." Although the present species does not establish itself permanently in the dwellings of man, after the manner of that pretty and amusing little pilferer the common House Mouse, I have known several instances of its having been caught in houses; and it often visits dairies for the sake of the milk, of which it is particularly fond. One which had escaped from its cage here was caught a fortnight afterwards in the same room, looking as sleek and well as ever.

I have on two separate occasions, in July and November, seen this little animal among the tall marram-grass on the sea-beach between Dunwich and Sizewell, on the Suffolk coast. Nests of the Harvest Mouse, *M. messorius*, have also been found on the beach at Kessingland, a few miles farther to the north, as recorded in Mr. Southwell's 'Mammalia and Reptilia of Norfolk.' The never-failing supplies of food cast up or left bare by the waves, as is well known, attract to the sea-coast various creatures other than those of purely littoral habits. Possibly, however, these beach-mice, instead of deriving the principal part of their food directly from that source, may subsist chiefly on the seeds of this grass and of the various plants growing on that wild and uncultivated tract. The beach being cut off at this spot from cultivated soil by a wide belt of marshes, ill adapted to the requirements of these animals, it seems probable that they may be permanent residents there. Rats, Rabbits, and a few Hares frequent the place; and even Weasels and Stoats in small numbers here find a temporary refuge from their relentless enemies the keepers.

Long-tailed Field Mice and Bank Voles, *Arricola rufescens*, often make use of the same runs, and in trying to procure specimens of the latter I have frequently been balked by the Field Mice, which spring the traps and imprison themselves with the greatest readiness. They are particularly abundant here, and on going out at night with a lantern are sometimes to be seen bounding along in their peculiar zigzag and erratic manner. Their leaping mode of progression occasioned by the comparative length and power of the hinder limbs, and in fact the appearance in general of these mice, reminds one of the Kangaroos, or perhaps even more so of their near relatives the Gerboas. When moving

slowly about in a cage their movements are very kangaroo-like. In burrowing, the snout is used for shovelling the earth away in front of them. In captivity they have—as far as my experience goes—rather a dull and listless manner, and, in spite of their beauty, make less interesting pets than the common House Mouse. The skin of the tail, as with the Dormouse, is but slightly attached, and if seized by that appendage the mouse generally escapes, leaving the skin between the finger and thumb of its would-be captor.

THE FINWHALE FISHERY OF 1886 ON THE LAPLAND COAST.

BY ALFRED HENEAGE COCKS, M.A., F.Z.S.

THE Finwhaling season of 1886 off the N. coast of Norway and Russia proved a good one as far as the number and size of the Whales obtained goes, but, owing to the continued low prices of oil and baleen, it is not every company that is satisfied with the result ; and I think everyone concerned is ready to acknowledge that they are treading seriously on one another's heels.

Rudolphi's Rorqual, which in 1885, for the first time on record, appeared in such large numbers to the eastwards of the North Cape, last year confined itself again to its usual habitat, only eight individuals being taken by ships of the companies having their stations to the east of that headland, and it is quite likely that some, and possibly all, even of this small number were actually killed to the *westward* of it. None were even *seen* by the Russian boats.

The Blue Whale reappeared last year in more like its former numbers, but, as will be seen by anyone who will take the trouble to compare the numbers caught by each company last season with those killed in 1884 (published in 'The Zoologist' for 1885), there was an appreciable falling-off in this species as regards the Norwegian coast, though apparently this was not the case in the eastward portion of the Russian waters.

A similar comparison for the last three years (1884, 1885, 1886) of the numbers of Common Rorquals killed will show a steady increase each succeeding year, the totals for each company in 1886 averaging more than double the number obtained in 1884.

The total of Humpbacks killed in 1886 was as nearly as possible the same as in 1885, and if, as in the preceding species, we reckon the totals for the three years, only of those companies of which I had returns in 1884, we find the figures so nearly alike that, without complete returns, it would be impossible to show any difference.

On my outward passage over the North Sea, when about 152 miles from the Spurn, on the afternoon of August 6th, or, roughly speaking, in about $55^{\circ} 33' N.$ lat., and $1^{\circ} 52' E.$ G., we passed tolerably close to some Rudolphi's Rorquals. There were, I am nearly certain, three of them, though it is possible that there were, as conjectured by some of the other spectators, only two. They kept blowing for some minutes, as we crossed their track, and occasionally putting their heads out of the water. The position indicated would be about the latitude of Bamborough, on the Northumberland coast, and inside the forty fathom line, clear of the N.W. margin of the Dogger Bank. I saw them well enough to feel confident in my identification, though it was not a species one would expect to meet with thereabouts, and to see any species of Whale there is an exceptional incident. The Whales were heading about W.N.W., and as that course (or within several points of it) would bring them before very long to the Scotch coast, I lost no time, after landing in Throndhjem, in writing to apprise Mr. Southwell of the likelihood of a visit being paid to the British coast by this rather rare species, and begging him to keep a look-out in the newspapers in case any arrival should be chronicled. Mr. Southwell was good enough to take a great deal of trouble in the matter, and in a few days heard of a Whale ashore, which is worth putting on record here, although it was probably not one of the individuals he was on the look-out for. On August 14th, three fishermen off the Island of Bernera, on the west coast of Lewis, heard a tremendous noise proceeding from a small creek called Sandy Cove. On getting nearer, they found a Whale fixed across the entrance. One of them, named Angus M'Arthur, landed and aimed a blow at its head with an oar. The Whale lunged to one side, and brought down upon itself a piece of rock estimated at over a ton in weight. The fishermen then attacked it, and with much difficulty, after a prolonged resistance during which it brought down several more pieces of rock in its struggles, they succeeded in killing it.

The men tied a rope to its tail, but it broke it and nearly wrecked the boat. Its length is said to have been about fifty-four feet, and, from the only description Mr. Southwell succeeded in obtaining in answer to his enquiries, it was evidently either a Common or Rudolphi's Rorqual, as it had "longitudinal folds of a whitish colour on the lower part" of the body; if it had been a Humpback, the remarkable flippers would almost certainly have been mentioned. It had been seen for about fourteen days previously in Loch Roag "pursuing small herrings," accompanied by a smaller one. It was purchased by Mr. J. N. Anderson, of Stornoway, who had it towed there.

When "Indenskjærs," that is, inside the barrier of the skerries, in the neighbourhood of Bergen, on August 8th, we saw a Lesser Rorqual; and a good many Dolphins, probably *D. tursio*. As I proceeded north, numerous Dolphins (? *D. tursio*) between Rörvig and Fjeldvig, and a single one in Porsanger Fjord, were the only cetaceans seen. Vest Fjord was passed earlier than I expected,—during the small hours of the morning,—and though exceptionally calm, no Whales were seen by the watch. In Öxfjord (West Finmarken), on August 15th, I saw the krang of a young male Bottlenose (*Hyperoodon rostratus*), which, I was told, measured from 2 to $2\frac{1}{2}$ fathoms, and had been picked up in Sörö Sund about three weeks previously, then recently dead, and with no mark externally to account for death.

When returning from visiting the whaling establishments, Capt. Horn kindly gave me a passage on the 'Murmanetz,' when she and the 'Welda' started homeward bound from Yeretiki on September 10th; and I proceeded in her all the way down to Throndbjem, where she and her consort were laid up for the winter. In spite of very heavy weather, we saw several Whales on the passage. On the 14th, in a heavy sea off Bryniln, between the islands Loppen and Löögö, we passed a small Whale. On the morning of the 15th, near the head of Vest Fjord, about three-quarters of an hour's run south of Lödingen, blowing hard W.N.W., passed a Humpback to starboard of us; and about ten minutes later, on the opposite side of us, we passed a school of from ten to twenty "Sværd Fisk" (Sword-fish). They were, I suppose, Killers (*Orca gladiator*), although, so far as my observations went, their appearance did not correspond well with that species; but as such a mass of widely divergent descriptions

have been given of what is after all, so far as we yet know, only one species, I think it best not to add to the existing confusion by publishing a fresh description which I am not able to substantiate.

Ten minutes later we saw another Humpback to starboard. Less than half an hour later, a Blue Whale was blowing very strongly on our starboard side; and half an hour later, again, what were probably three "Sildehvale" (the "Herring-whale" variety of the Common Rorqual) to port of us; and then another Whale was sighted just beyond these by one of the men, which, presently coming rather close to us, proved to be a Common Rorqual. A little farther on, again, far away to port, another Whale, which blew frequently, but too far off to identify, was supposed to be either a "Sildehval" or a Humpback; and in the evening, about an hour's run (nine knots) south of Bodö, we passed a small Whale. Capt. Horn coming through Vest Fjord on his way south, on Oct. 1st, passed four "Sildehvale" within a short distance of Lödingen.

The last Whale I met with was only about fifty miles from the Yorkshire coast, as we were running towards the Humber on the morning of October 10th. On the fishing ground known to trawlers as the "Great Silver Pits" (20 to 40 fathoms) we passed close to a Dutch fisherman from Schlevingen, in the act of hauling in his net. About fifty Gannets were in attendance overhead, while below a small Whale—perhaps a Lesser Rorqual—was steadily breakfasting on the fish that managed to escape from the meshes of the net.

With regard to the time when the different species of Finwhale appear on the North European coast, I have the following observations of some of the whalers this last season to offer (the actual date of the killing of the first and last example of each species being stated farther on under the respective species). Probably the first Whale killed last year was a Humpback, yielding six and a half tons of oil (about thirty-nine barrels), killed by Capt. Selliken as he entered Syltefjord on February 24th. Humpbacks are said to arrive on the E. Finmarken coast every February, but the weather was so bad this year as to hinder the fishing; but it is probable that their numbers are recruited towards the end of the fishing season. Capt. H. Ellevsen came "Indenskjærs" all the way up the coast in the spring, that is, inside the outer belt

of islands, and therefore saw nothing; it was too rough while he was crossing Vestfjord to see anything. Herr Wiborg saw a few Common Rorquals on March 24th between Nordkyn and Vardö, and had seen none previously on his passage. Capt. Berg saw none on his passage north. Capt. H. Ellevsen saw several Common Rorquals on March 23rd between Tanafjord and Sylte-fjord; and between May 25th and June 26th Whales were numerous between Tanafjord and North Cape. Capt. Berg says, "From May 27th to June 20th there were, off and on, great quantities of Whales between North Cape and Tanahorn, especially about the Nordkyn; these Whales were Common Rorquals or Whales resembling the so-called hybrids (Bastarder). We had first in July a large show of Whales N.E. of Sylte-fjord; these were typical Common Rorquals; at the same time there were also sundry Blue Whales off Sylte-fjord, though no remarkable number. In April there was a stray Common Rorqual, off and on, between Tanahorn and Vardö, but the weather was then stormy, so that it hindered the fishing." Capt. Sörensen reports, "During the month of June there were often a quantity of Common Rorquals collected about Nordkyn and North Cape." Herr Wiborg says, "A quantity of Common Rorquals were seen in the middle of June between North Cape and Nordkyn. About the middle of July there were not a few Blue Whales about eight (sea) miles (= thirty-two English land miles) N.E. of Vardö, on their passage eastwards. A few days later there were a quantity of Blue Whales congregated off the Seven Islands (Sem Ostrova), on the Murman coast." Capt. S. A. Nilsen, of the 'Murmanetz,' told me that, with the exception of 1885, when the extraordinary arrival of Rudolphi's Whales took place, he had seen more Whales this season than in any previous year.

Mr. Robert Gray's very interesting notes on last year's voyage of the 'Eclipse,' in the present volume of 'The Zoolologist,' help to show the distribution of the Blue Whale during the spring and early summer, and he corroborates the opinion I expressed in these pages in 1884, that the statement in Nordenskiöld's 'Arctic Voyages,' that the "Finners" never live in colder water than $2\cdot5^{\circ}$ C., is an error. Capt. Castberg, jun. (commanding a Norwegian Greenland whaler) also reported seeing, in 1886, Blue Whales among Bottlenoses off Grimsey (an island off the N. coast of Iceland), in 67° N. lat., and between the 17th and

18th degree long. W. G.; and that off Langenæs (the N.E. headland of Iceland), on May 28th, he saw quantities of this species.

The following particulars, kindly supplied to me by the managers whose names are affixed, will, I believe, be considered well worth recording. With one or two exceptions, the original statements were given me in Norwegian; these I have endeavoured to translate as accurately as possible. The lengths, except where otherwise stated, are in Norwegian feet and inches (the Norwegian foot = almost exactly 1 ft. 0 $\frac{1}{2}$ in. English, and therefore the Norwegian inch = about 1 $\frac{1}{4}$ in. English). But as most of the measurements are given in feet, omitting inches, it would have been absurd for me to have reduced them to English feet, plus the odd inches.

HUMPBACK. — Capt. Horn obtained: Males (June 19), 43, 41, 42, 53, 28, 42 (Aug. 2); females, (July 1) 45, with male foetus 13 in. long, flipper 3 in., width of flukes 3 in., gape 2 $\frac{7}{8}$ in. (much milk); 48 (July 28). Average: (6) males, 41 $\frac{1}{2}$ Eng. ft.; (2) females, 46 $\frac{1}{2}$ Eng. ft. In 1885 he obtained: (Aug. 14) 31 and 36 (Aug. 15) 38. Average: 35 Norw. ft.

Capt. Andreeff obtained: Males (July 9), 38 $\frac{1}{2}$, 32; females (Aug. 21), 35. Average: (2) males, 35 $\frac{1}{4}$; (1) female, 35.

Herr Wiborg obtained: 1 male (Aug. 2). 3 females (Aug. 6-16).

Capt. Castberg obtained: Males (June 19), 30, 20, 30, 28, 20, 30. No females. Average: (6) males, 26 $\frac{1}{2}$ Norw. ft.

Capt. Berentsen obtained: Males (Aug. 3), 30 and 30; females (June 9), 30; (July 14) 46. Average: (2) males, 30; (2) females, 38 Norw. ft.

Capt. Sörensen killed 4 and found 1 dead between August 2nd and 6th. Length, about 40 Norw. ft.

Capt. H. Elleksen's 5 were obtained between July 28th and August 17th. Four were males, and only one a female.

Capt. Berg obtained 4 males, and no females. (July 23) 47, 40, 44, 38 (Aug. 7). In 1885 he killed 2 as late as Aug. 19. In 1884 he killed no Whale of any kind in August, although his ship cruised until the end of that month. In 1883 he obtained 1 on Aug. 30. In 1882 his last Whale was a Blue Whale, killed Aug. 21.

Capt. Selliken took 6; the first was as he came to Syltefjord at the commencement of the season; it gave 6 $\frac{1}{2}$ tons oil (= about 39 barrels). One of his ships harpooned a small individual in the

head (apparently penetrating to the brain). It towed the ship straight towards land, and the crew were in imminent danger of being shipwrecked on the rocks. Presently it reared its head right out of the water, and nearly toppled over on deck. Despite all their efforts the crew could not succeed in killing it, and at last they lashed it head and tail alongside and proposed to tow it ashore, still alive; but it broke the lashings, and was only finally secured after a great amount of trouble. A foetus found on July 28th measured $17\frac{1}{2}$ Norw. in.; flipper, $4\frac{3}{4}$.

Herr Andresen obtained: Males, 35, 42, 39, between July 7 and 29, and no females. Average: (3) males, $38\frac{2}{3}$ Norw. ft.

On August 25th I saw the 'Varanger' with one alongside, not much more than 20 ft; it was black-bellied. The great apparent excess of males over females of this species has struck me since I first visited the Whale-factories; this season, out of 37 of which the sex is recorded, 28, or over two-thirds, were males. This is evidently not to be accounted for by supposing that male animals are selected where there is a choice, on account of greater size, for the exact contrary is the case. The average for all the males whose length is given above is under $35\frac{1}{6}$ Eng. ft., while that of the females is just over $40\frac{1}{2}$ Eng. ft.*

Herr Wiborg informs me of a Humpback seen this season, accompanied by two calves, each about 10 Norw. ft. long. "This Whale was very shy, so that, so far as I am aware, it was not captured. Several whalers state that they have seen what was probably the same Whale. It was seen off Vardö, about six (sea) miles (= 24 English land miles) from land."

BLUE WHALE.—Capt. Horn obtained some extremely large Whales. Males: May 25, 80 Eng. ft.; June, 80 Eng. ft.; July, 76, 81, 68, 84, 77, 81, 72, 78, 75, 80, 63, 76, 83; Aug., 80, 72, 85. Females: June, 80, 81 (containing foetus 5 ft. 7 in. long); July, 87 (accompanied by young one between 50 and 60 ft. long), 80 (containing foetus 15 ft. 6 in. long), 71; Aug., two of 77 ft. Total (18) males, average, $78\frac{7}{8}$ Eng. ft.; (7) females, average, 79 Eng. ft. The Blue Whales taken by Capt. Horn in 1885 were: June (1st), 68 Norw. ft.; (6th) female, 72; July, 67, 77; female, 81; Aug., 83, 71; female, 82 (with milk running); male, 75; female, 81 (Aug. 9). Average length (irrespective of sex) of 10 = $75\frac{7}{10}$ Norw. ft.

* Reckoning 1 ft. $0\frac{1}{2}$ in. English, to the Norwegian foot.

Capt. Andreeff, at Arra Guba, obtained: Males, 62 (middle of June), 64, 73, 67, 51, 60, 72; females, 70 $\frac{1}{2}$, 75, 52, 77, 70, 67, 79. Average: (7) males, 66 Eng. ft.; (7) females, 70 $\frac{1}{4}$ Eng. ft.

Herr Wiborg, of Kiberg, obtained, on June 21, a female containing foetus 9 ft. In July, 5 males, and 2 females, one of which (killed 10th) was accompanied by a calf about 40 ft. long; and on Aug. 20, a female, with foetus 8 ft. The length of these Whales was from 65 to 80 Norw. ft., and most of them were extremely fat. Herr Wiborg writes as follows (translated):—"Manager Amlie of this place (Christiania), who carries on Whale-fishing at Iceland, told me a few days ago that he had this year shot a poor Blue Whale, which had a shell lodged in the back part of the head, near the blow-holes, of the kind we use in Finmarken. Herr Amlie supposes that the Whale was shot or wounded by the Finmarken whalers, which is also the opinion of Herr Amlie's harpooner. The wound was thought to be a year old." Herr Wiborg also noted that about the middle of July, about eight sea miles N.E. of Vardö, there were a good many Blue Whales travelling eastwards; and some days later there were a quantity of this species congregated outside the Seven Islands (Sem Ostrova), on the Murman coast. Capt. Berg noted the appearance of some Blue Whales off Syltefjord during the early part of July, "though no remarkable number."

Capt. Castberg obtained, on June 2, a female 78 Norw. ft., containing foetus 3 $\frac{1}{2}$ Norw. ft.; July 1, female 78 ft. 6 in. Norw.; and on the 23rd a male 72 ft. Average: (1) male, 72 ft.; (2) females, 78 ft. 3 in. Norw.

Capt. Berentsen obtained, on June 8, a male 76 Norw. ft.; 30th, female 76 ft.; in July, 1 male, 2 females, each 74 ft., in August, a female 75 ft.; this last was in lean condition, and only yielded about 40 barrels of oil. Average: (2) males, 75 ft.; (4) females, 74 $\frac{3}{4}$ Norw. ft.

Capt. Sörensen obtained 7 between June 30 and July 15, and they measured between 70 and 75 Norw. ft.

Capt. H. Elleksen obtained 10 between June 8 (77 Norw. ft. long) and Aug. 7, when one was found floating dead.

Capt. Berg obtained: Males (June 30), 61; (July), 74, 70; females (June 28), 68; (July), 68, 67, 68, 74. Average: (3) males, 68 $\frac{1}{2}$; (5) females, 69 Norw. ft.

Capt. Selliken's largest Whale (of 4) was a male, 82 Norw. ft.

Herr Andresen obtained, between June 10 and July 17: Males, 74; females (June 10), 72, containing foetus 50 Norw. in., 68, 84. Average: (1) male, 74 Norw. ft.; (3) females, 74 $\frac{2}{3}$ Norw. ft.

The sex of a Blue Whale (and in a less marked degree it is, I believe, true of other species of *Balaenoptera*, and possibly of other whalebone Whales) may be distinguished by the shape of the baleen plates, which in a male are long (up to 4 ft., including gum) and narrow, but thick; while in a female they are short and broad, but thinner.

While at Mehavn (where we had to take shelter in heavy weather on our way south in the whaler 'Murmanetz'), I found quantities of the copepod, *Balaenophilus unisetus*, on baleen of the Blue Whale. Capt. S. A. Nilsen, of the 'Murmanetz,' told me that on August 5th he saw two males of this species making overtures to a female. He harpooned one of the males, on which the other supposed male sprung clean out of the water head first, and nearly fell on board the ship!

COMMON RORQUAL.—That this species is extremely variable is only too well known, for it has led to the multiplication of species and great confusion; but, according to the reports of the Finwhalers, who have had during the last few years opportunities never before accessible of examining in a fresh state large numbers of these animals, it seems as if these differences might perhaps be classified under three constant varieties—although it must be allowed that these varieties are not as yet as clearly defined as could be wished; however, I here quote the descriptions as given me. Capt. Sörensen says, "On the western and southern coasts of Norway a sort of Whale is met with during the herring-fishing, often in great numbers, which is called Herring Whale (Sildehval). This Whale is most like the Capelan Whale (Loddehval), but smaller than it, rarely longer than 50 to 55 ft. It is black on the back, white on the belly, and the baleen like the Common Finwhale's (*i. e.*, the Capelan Whale). Its dorsal fin is somewhat higher and more pointed than the Finwhale's, and it yields less oil than that kind." He adds that the "Sildehval" is the southern kind, and the "Loddehval" is the common Finwhale of the north.

Capt. H. Elleksen says, "The common Fin- or Capelan-Whale

disappeared at the end of April; it is white under the belly. The Finwhale which then came has more or less dark grey colour among the white, especially on one side; its snout is generally more pointed, and the Whale is more slender and longer"; and adds that the Finwhales that eat Lodde (Capelan) are only in Finmarken waters in the spring, and that those that eat Kril (*Calanus finmarchicus*) come later.

Capt. Castberg described the "Herring Whale" as much resembling the Blue Whale; the head like a Blue Whale's; the line of the back much bowed posterior to the dorsal fin; the furrows on the belly are after the pattern of a Common Finwhale, except that they are narrower (the furrows in the Blue Whale are shallower and narrower, and more numerous than in the Common Rorqual); the flukes more like those of the Blue Whale than the Common Fin.

Capt. Horn has only seen one Whale answering the description given by Capt. Castberg of the "Sildehval"; it was a male 63 Eng. ft. long, killed August 21st last; it was almost black on the back (blacker than a Blue Whale); at a very short distance behind the dorsal fin the line of the back bent abruptly down (as if humpbacked); the dorsal fin was farther aft than usual; the difference in colour caused it to look very different; it was extremely tough and hard; an example of 49 ft. probably produced more oil than this one.

A Norwegian who was one of the first colonists to settle on the Murman coast told me that he knows the "Sildehval"; it is like the Whales found about Bergen, and is black on the back; it arrives on the coast with the herring, for which there is no fixed time.

Nearly universally recognised among the Finwhalers is the so-called "Bastard," from its having been supposed to be the offspring of mixed parentage—of a Blue and Common Rorqual. This variety appears to attain to larger dimensions than the typical form, and is described as *grey*, rather than the usual white, on the under side; on one side the baleen plates are for a short distance at the anterior end entirely white, while the remaining portions are darker than the normal colour. The following lengths of specimens of *B. musculus* were given me; I have kept the "Bastards," where mentioned, distinct from the common form:—

Capt. Horn obtained: (measured in English feet) Males, April (4), Fin, 64, 65, 66, 68; Bastard, 67; May, Fin, 62; Bastard, 72; Fin, 65; June, Bastard, 71; July, Fin, 65; Aug., Fin, 63, 64, 49, 63 (this last was the Herring Whale before mentioned). Females, April (6), Fin, 571; Bastard, 80 $\frac{1}{2}$ (very fat), 64; May, Fin, 64 (containing foetus about 15 $\frac{1}{2}$ in. long, gape of mouth 3 in., length of flipper 1 $\frac{3}{4}$ in., across flukes 2 $\frac{1}{2}$ in.); June, Fin, 64 (foetus 3 ft. 8 in.); July, Fin, 68 $\frac{1}{2}$, 69; Bastard, 70 (foetus 22 $\frac{7}{8}$ in. long, gape of mouth 4 in., length of flipper 2 $\frac{3}{4}$ in., base of dorsal fin 1 $\frac{1}{16}$ in., across flukes 4 $\frac{3}{4}$ in., on upper mandible 7 hairs on left side, 8 on right, and 17 on the lower mandible). Average: (14) males, 64 $\frac{1}{4}$; (8) females, 68 $\frac{7}{8}$ Eng. ft. It will be seen from the above figures that of 16 typical Common Rorquals, only 1 reached 70 ft.; while out of 6 of the "Bastard" variety, 4 were 70 ft. and upwards, 1 reaching the remarkable length of 80 $\frac{1}{2}$ Eng. ft. This Whale was shot by the 'Murmanetz' on April 9th, the harpoon going well in just behind a flipper, that is, somewhere very close to the heart, and the shell exploded. The wound, instead of proving almost immediately fatal, seemed to madden the victim, and it rushed away at great speed and towed the steamer, with the propeller working full speed astern, for four hours; when the 'Welda' being sighted, she was signalled to assist, and this vessel, steaming up at an angle, succeeded in lodging a harpoon just behind the flipper on the opposite side to the first; this shell also exploded properly. The Whale in this mortally wounded condition actually towed the two steamers steaming full speed astern, with a boat from each constantly lancing it, for two hours before it succumbed.

Capt. Andreeff obtained: (measured in English feet) Males (June), 49, 62, 61; females, (April 13) 65, 63, 71, 70, 63, 60, 60, 68, 69, 64, 62, 54, 61 (Sept. 8). Average: (3) males, 57 $\frac{1}{3}$ ft.; (13) females, 63 $\frac{11}{12}$ ft.

In 1885 Capt. Horn obtained: (March 20) Fin, 64, 65, 60, 58; Bastard, 71; Fin, 59, 62 (female with foetus 4 ft. long), 58, 64, 59, 62, 56, 63, 58, 58, 61, 55, 57, 61, 58, 59; Bastard, 70; Fin, 63, 58, 54, 57, 57, 64. Average: (28) 60 $\frac{11}{16}$ Norw. ft.

Herr Wiborg obtained between April 6 and Aug. 2: Males (including a Bastard about 70 Norw. ft., killed June 2), 13; females, 10. On May 20th a female contained a foetus 4 Norw. ft.; on the 28th he found one of 3 ft.; on June 9th, one of 5 ft.; and on July 26th, one of 7 ft.

Capt. Castberg obtained: Males (April 4), 70, 58, 61, 62, 62, 55, 50, 58, 64, 65, 64, 69, 63 ft. 6 in., 67, 58, 67, 60, 65, 65, 63, 63, 45 ft. 5 in. (Aug. 5); females (My 9), 40, 65 (killed May 21, containing foetus 5 Norw. ft.), 63, 73, 60, 70 ft. 3 in., 66, 63, 59, 60 (July 5, foetus $5\frac{1}{2}$ ft.), 53, 65 (July 7, foetus $6\frac{1}{2}$ ft.), 67 (July 8, foetus 6 ft.), 66 (July 9, foetus $6\frac{1}{2}$ ft.), 65, 63, 65 (July 24, foetus 7 ft.), 62, 64, 65, 60, 67 (Aug. 18). Average: (22) males, 61 $\frac{1}{2}$ Norw. ft.; (22) females, 62 ft. 9 in.

Capt. Berentsen obtained: Males, (April 12) 60, 58, 60, 54, 59, 60, 67, 62, 60, 64, 63, 57, 67, 57, 60 (July 24); females, (April 6) 58, 61, 63 (May 2, foetus 4 ft. 4 in. Norw.), 68 (May 26, a great quantity of milk, probably recently calved), 67, 62, 56, 62, 62, 67, 59, 70 (July 5, foetus 6 ft.), 68, 62, 59, 66 (July 11, foetus 6 ft.), 68, 66, 69, 60, 70, 60 (Aug. 7). Average: (15) males, 60 $\frac{1}{2}$ Norw. ft.; (22) females, 63 ft. 9 in. Norw.

Capt. Sørensen's 20 specimens were from 60 to 65 Norw. ft. The first was killed April 5, the last July 28. On July 10 he found a foetus 4 ft. 8 in. Norw. long.

Capt. H. Ellevsen obtained 57 between March 29 and Aug. 18, and found 4 foetuses: on June 18, in a Whale 56 Norw. ft., a foetus 2 ft.; on the 20th, in a Whale 54 ft., a foetus 3 ft.; on the 24th, in a Whale 58 ft., a foetus 4 ft.; and on July 7, in a Whale 66 ft., a foetus 8 ft. 1 in.

Capt. Berg obtained: Males (April 6), 62, 60; Bastard, 58; Fin, 59, 64, 58, 62 (June 20); females, (April 15) 70, 56; Bastard, 61 (June 4, foetus 3 ft. 3 in. Norw.); Fin, 55, 74 (June 10, foetus 8 ft.), 53, 65, 59 (July 1, foetus 5 ft. 5 in.), 60 (July 12, foetus 1 ft. 5 in.), 67, 69 (July 27). Average: (7) males, 60 $\frac{3}{4}$ ft.; (11) females, 62 $\frac{1}{4}$ Norw. ft.

Capt. Selliken captured a Common Rorqual this season 76 $\frac{1}{2}$ Norw. ft. long in a straight line.

Herr Andresen obtained: Males (April 12), 50, 56, 66, 64, 62, 66, 60, 64, 64, 62, 62, 60, 63, 63, 58, 57, 61, 62, 50 (Aug. 17); females, 52, 66, 66, 68, 62, 68, 64, 62, 59, 66, 64, 64. Foetus in Whale 68 ft., on June 29, 8 ft.; and in a Whale 64 ft., on July 24, 9 ft. Average: (19) males, 60 $\frac{10}{11}$ ft.; (12) females, 63 $\frac{1}{2}$ Norw. ft.

Capt. S. A. Nilsen, of the 'Murmanetz,' says that he sees Common Rorquals pairing during May, up to about June 1st every year; and that in the spring they have calves by their sides not more than 8 or 9 ft. long. He thinks the young Whales (first calf) pair in the autumn.

RUDOLPHI'S RORQUAL.—Capt. Castberg's single example of this species was a male 45 Norw. ft. long, killed on June 19th; it was one of a school numbering about 20.

Herr Andresen obtained (June 8) female 42 Norw. ft., female 50, male 40, male 42; (July 3) female 48, with foetus 2 ft. 1 in. Nor.; female 44, female 48 (July 26). Average, (2) males, 41; (5) females, 46³ Norw. ft. On July 18, 1885, a female Rudolphi was brought in to his factory at Tufjord (close S.W. of North Cape) 45 Norw. ft. in length, in which were found two foetuses of opposite sexes; the male measured 6 ft., and weighed 48 kilograms; the female measured 4 ft., and weighed 30 kilograms.

Capt. H. Ellevesen's ships reported seeing some Rudolphi's on June 2nd, off Nordkyn.

One of Capt. Selliken's whalers cruising about fifty English miles north of Kongsfjord (the next Fjord to the westward of Sylte-fjord) during splendid weather in April, the sea perfectly calm, fell in with thousands of Seals (? sp.). If, as I believe to be the case, this is well out of their usual track, it would perhaps be the result of an unusual condition of the ice to the north, the edge being reported very low down off these coasts this season.

While staying in Syltefjord, I walked over from Capt. Selliken's to Capt. Berg's factory on Aug. 18th, and as I approached the first batch of Whale-krangs near the latter's I put up no less than twenty Ravens in a flock from them. I do not recollect to have previously seen quite so many together. All the factories have an inclined plane from the ground to the upper part of the boiling-house for the trolley to run up with the "blanket pieces" of blubber. The angle formed by the last few feet at the bottom is usually boarded in, to form a tool shed or sort of boatswain's locker. A pair of White Wagtails (*M. alba*) had found out a crevice at the top of one of these boards, and had built a nest inside, in the dark, and immediately under the rumbling trolley. The store of empty barrels was kept on the beach, enclosed by a turf wall (forming exactly what would be called a "Tun" in Iceland). In the interstice between some of the sods another pair of Wagtails built a nest, but, as it was entirely exposed to the rain, the cooper fixed half of a cask-head over it to form a roof, which, I was told, the birds had much appreciated. The young had flown from both nests at the time of my visit, but the nests remained; they were formed of very fine root-fibres and a little

moss, lined with reindeer-hair, and a few horse- and cow-hairs, and very fine fibres. The fibres of the nest under the inclined plane were coarser than those used in the sod bank.

With regard to the average yield of oil from each species of the *Balænoptericæ*, I made further enquiries this season on the subject, and the general opinion among those whom I consulted was that the estimate published in 'The Zoologist,' 1886, p. 122, is rather a low one; but in answer to that I would point out that the total yield of oil this year, inclusive of the 4th quality obtained from the krangs by those companies that have guano-factories, is, according to the returns given me, about 29,959 petroleum-casks. Calculating the yield from the Whales obtained, even according to this low estimate, the amount would be 28,510 petroleum-casks of the first three qualities of oil, and if we add to this, say, 3000 more for the 4th quality oil, the result is much above the actual amount said to have been obtained. But from the differences between the individual results, it seems difficult to arrive at any figures that would give a true average.

The average boilers in use in the factories hold about 2000 gallons; but more than about 1700 gallons of Spæk cannot be boiled in them, and this latter amount produces up to about 18 petroleum-casks of oil (say, 750 gallons).

The following prices offered for baleen about the middle of the season show the relative values per ton in each species; each plate to be not under 35 centim. long ($= 13\frac{3}{4}$ in.):—Blue Whale, £65; Rudolphi's Rorqual, £40 to £45; Common Rorqual, £30; and Humpback, about £30.

Some idea of the size of the harpoons used may be gathered from the weight of one. Including the wire grummet, the cord, and spunyarn lashings, but without the shell or whale-line, it scaled 56 kilo. (that is, over 123 lbs.). The cost of each is 80 Kr. ($= £4 9s.$) as it leaves the blacksmith, and nearly 100 Kr. (more than £5 10s.) when ready for use. In an old volume of the 'Ny illustreret Tidende' (Christiania, May 11, 1884, p. 174) there is some account given of Capt. Svend Foyn and the Finwhaling: it is there stated that the shell-carrying harpoon is said to have cost him 160,0000 Kr. (over £8800), when the various experiments undertaken are included!

I have to thank several of the managers whose names are mentioned in the preceding pages for the information they kindly

gave me; and especially are my thanks due to Capts. Selliken, Berg, and Horn, who put me up most hospitably at their respective factories, and the latter in addition gave me a passage in one of his whalers all the way from Yeretiki to Throndhjem. Capt. Sørensen, in addition to other information, filled up, as in previous years, some gaps in the table given at the end, of the Finwhaling Companies and their takes in 1886.

There is one more Rudolphi's Rorqual to be added to last year's list, obtained by Herr Gjæver, of Tromsö; and Herr Goebel on the Murman coast was credited with one Blue Whale too many, leaving the grand total of Whales killed during the season the same.

In the following table the new names are as before, printed in italics. The establishment at Baadsfjord is not exactly a new Company, being the one which was formerly at Akerfjord on Söröen; Capt. Foden, the manager, was formerly captain of Capt. Selliken's whaler, the 'Skytten.'

In the following table the column giving the approximate amount of oil obtained by all the companies is a new and I think interesting feature, which I was requested by some of the managers to publish. I have replaced the second "r" in Arra, as the word signifies a Guillemot in Russian, and is likely to be the meaning in this instance. (Cf. *Alca arra*, one of the synonyms for Brunnich's Guillemot, which is simply two onomatopœic names for a Guillemot—Alka, Swedish (Alke, Norwegian), and Arra, Russian.

In the annexed table, the Tromsö establishment being the only one from which I have learnt no particulars as to the species of Whale, I have divided the total of 22 by guesswork, and put in the details in Roman figures, in order to arrive at an approximate total of each species.

Since the above was in print, a paragraph has been published in the evening papers of March 28th, stating that the 'Vardöhus' started from Sandefjord for this season's whaling on the 23rd of that month, and was wrecked during the night off Mandal. "Only two men were saved out of her crew of about fifty." I have written to make enquiries, but up to the present have learnt no particulars of this disaster.

COMPANY.	MANAGER.	PORT OF REGISTER.	PETROLEUM CASKS OIL, ALL QUALITIES.*	WHALERS' NAMES.
Murmansk Coast: Yeretiki Arra Guba	P. A. Horn Andreeff	Petersburg... Do.....	25 22 0	55 33 About 1000
E. Finmarken: Kobholmtjord Stokke, Pasvig	(Capt. Imp. Russ. Navy) Frederiksen ... A. Ellevsen ... Evensen	Sandefjord... Tønsberg ... Do..... L. Hansen ... C. Bruun ... Tønsberg ... Throndhjem... Christiania...	6 15 0 36 2 4 7 9 3 44 6 37 1 3 22 1 3 24 1 2	26 6 70 1 46 7 33 0 1 6 4 47 0 26 2 30
Jarfjord	L. Hansen	Christiania...	5 1 22 0 0 7 0 23 1 37 1 22 1 1 2	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., Madvig	C. Bruun	Tønsberg ...	5 0 1 1 1 1 0 0 1 1 1 1 1 1 1 1	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., Tanaasjok	T. Wiborg	Throndhjem...	5 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	950 2207 1400 850 408 About 1050 2230 1320 650 750
Kiberg.....	Castberg	Christiania...	5 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	950 2207 1400 850 408 About 1050 2230 1320 650 750
Busse Sund—Christiania Co.	Berentsen	Laurvig	5 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., Laurvig Co.	I. Bryde	Sandefjord...	5 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., “Thekla”	A. Grønn	Do.....	5 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., Bugten	G. Sörensen	Do.....	5 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., “Haabet”	H. Ellevesen	Tønsberg ... L. Berg	5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., Skjersnaes	M. A. Selliken.	Bergen	5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	950 2207 1400 850 408 About 1050 2230 1320 650 750
Syltefjord, Dahl's Exors.	Foden	Arendal	5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	950 2207 1400 850 408 About 1050 2230 1320 650 750
Do., Bergen Co.	S. Foyn	Tønsberg...	5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	950 2207 1400 850 408 About 1050 2230 1320 650 750
Baadsfjord	M. C. Bull....	Do.....	5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	950 2207 1400 850 408 About 1050 2230 1320 650 750
Mehavn	T. H. Andresen	Do.....	5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	950 2207 1400 850 408 About 1050 2230 1320 650 750
Ørvær, do.....	J. Gjæver	Tromsø	5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	950 2207 1400 850 408 About 1050 2230 1320 650 750
Tujord				
Tromsø				

* Formerly the ‘Madvig’.

** Most of the figures in this column are only approximate.

† Formerly the ‘Murdmanetz’.

ON THE STRUCTURE AND LIFE-HISTORY OF SPONGES.

By R. VON LENDENFELD, PH.D., F.L.S.

SPONGES are exceedingly variable in shape. Their primordial form is the same as that of the higher Cœlenterates, the Gastrula. The wall of the originally simple Gastrula-sac is folded considerably in the higher sponges. Great quantities of mesodermal ground-substance are produced and occupy these folds; thus the massive body of the sponge is formed. The gastral cavity becomes the oscular tube which communicates with the surrounding water by the oscula or vents. The terminal opening of large tubular sponges is generally not an osculum, but a pseudoscum. In that case the true oscula are situated in the inner wall of the tube.

The sponges which are regular in shape are mostly radially symmetrical, without distinct anti- or metameres. There are, however, also forms known with a definite number of antimeres, but these are rare. Only one bilaterally symmetrical sponge, a tree-shaped *Halichondrine* (*Esperiopsis challengerii*, Ridley), has been described hitherto. This consists of a slender cylindrical stem, to the sides of which regular bilaterally symmetrical, kidney-shaped fronds are attached by long peduncles. The *Hexactinellidæ* and *Syconidæ* are distinguished by their regular radially symmetrical shape. These are sac-shaped. The *Tethyidæ* are pretty regularly spherical. A great many of the *Chondrospongia* and most *Cornacuspongia*, particularly the Horny Sponges, are quite irregular in shape. The distinctive features of the species appear as combinations of peculiarities which are very unimportant in themselves, but which combined characterise the form and enable one to identify the sponges.

The size of sponges is, like their shape, subject to great variation. The smallest sponges, excepting the doubtful *Physemaria*, are the most simple forms of calcareous sponges, the *Asconidæ*. The largest forms we find among the *Chondrospongia* and *Cornacuspongia*. There is in the British Museum a fragment of a cylindrical *Suffaria* from the West Indies, which is nearly $1\frac{1}{2}$ metres long and 20 cm. thick. The specimens of *Euspongia* from the Bahamas, particularly the flat, cake-shaped forms, sometimes attain a breadth of 1 metre and a height of 25 cm. The largest sponges known are the species of *Poterion* described by

Harting. They are high, elegantly vase-shaped sponges, which attain a breadth of $\frac{3}{4}$ and a height of $1\frac{1}{2}$ metres. Mr. Ramsay dredged a massive *Raphyrus*, which weighed several hundred-weight, on the east coast of Australia.

The colour of sponges is also very variable. Hexactinellid and Calcareous sponges are colourless, and appear brilliantly white, in consequence of the lustre of their spicules. Most other sponges have brilliant colours. Mimicry is rare. Only the forms which possess a sand cortex correspond in colour to the sea-bottom on which they grow. Most *Chondrospongiae* and *Cornacuspiongiae* possess glaring colours, presumably for the purpose of warning and frightening other animals.

The changes of colour exhibited by certain sponges shortly after death are very interesting. Nardo drew attention to this fact in the case of *Aplysina aërophoba* as early as 1833. This sponge is bright sulphur-yellow in the living state, but when exposed to air, or fresh water, it changes this colour to dark blue.

The body of the higher sponges appears as a mass of mesodermal ground-substance, in which cells of various kinds are found. This mass is pervaded by a complicated system of frequently branching canals. All free surfaces are covered with epithelia. The canal system is transgressing, and is essentially different in this respect from the cæcal gastrovascular system of higher Cœlenterates. On the surface there are numerous small pores which lead into this canal system.

The entrances to the inhalent canals proper are not to be sought for in the pores of the skin, but lie in the floor of extensive subdermal cavities, into which the inhalent pores lead. Whilst the different parts of the subdermal cavities communicate with each other, the inhalent canals and their branches do not form any anastomoses in the interior of the sponge. They lead into the ciliated chambers, which are spherical or sac-shaped extensions of the canals, clothed with a peculiar epithelium of collared cells. The ciliated chambers possess very small inhalent pores, through which the water passes from the inhalent canal system; that is to say, the canals are very much constricted just before widening to form the ciliated chambers. The inhalent pores are more or less opposite to the exhalent pore, which is much larger and always single.

The canal system of different sponges is very differently developed. The form described above is that of the most highly developed sponges, the *Chondrospongiæ* and *Cornacuspiongiæ*. The entodermal as well as the ectodermal epithelia of sponges always consist of one single layer of cells only. In this character the main difference between sponges and higher Cœlenterates is to be found. In the latter the epithelia always consist of several layers of cells, from the lower subepithelial layer of which all the organs are developed.

The epithelial cells of sponges are of two kinds only—flat pavement-cells and collared cells. Each epithelial cell possesses a cilium. In the most simple sponges, the sac-shaped *Asconidæ*, the ectoderm consists of a single layer of flat cells on the outer surface of the sponge, and the entoderm forms a single layer of collared cells on the inner surface of the sponge; flat entodermal cells do not occur in these sponges. Whilst in all, even the most highly developed forms, the ectodermal epithelium invariably consists of flat pavement-cells, we find in all sponges, with the exception of the above-mentioned group, two kinds of entodermal cells—collared cells and flat entodermal pavement-cells. The collared cells are confined to the ciliated chambers, whilst the whole exhalent canal system and the oscular tube are clothed with a low epithelium of flat pavement-cells.

In the *Hexactinellidæ* the collared cells are connected with each other by basal processes; but, as a rule, they are isolated. Their shape is very constant—long, cylindrical, with a long, projecting, more or less cup-shaped, hyaline collar, which appears as a marginal extension of the free end of the cell. The long flagellum is inserted in the middle of the cup formed by this collar. Whilst the collared cells always appear to be filled with readily stainable granular protoplasm, the hyaline plasma of the low, flat cells is confined to a mass surrounding the nucleus, from which protoplasm-threads radiate to the protoplasmic coating of the cell-wall. It seems that the only difference between the ectodermal and entodermal pavement-cells is their difference of height. The former are mostly slightly lower than the latter.

The function of the pavement-cells does not appear at first sight to be a very important one, because these cells are not completely filled with protoplasm. The collared cells in the ciliated

chambers, on the other hand, appear to be active elements which perform an important function.

The mode and process of nourishment in sponges is very doubtful. Feeding experiments with carmine have shown that not only the collared cells, as was previously believed, but all the epithelial cells indiscriminately possess the power of taking up fine particles. Infusoria, &c., have been observed in the amoeboid wandering cells in the interior of the body; but nothing definite is yet known concerning the mode of nourishment. It is quite certain that the sponge must extract organic substances and oxygen out of the surrounding water somehow, and that the epithelial cells, being the only elements in contact with the water, must perform that function. It is also evident that sponges cannot devour large animals, as the extremely fine sieves which cover the inhalent pores, and the very small pores which lead from the inhalent canals into the ciliated chambers, make it impossible for large animals to enter the sponge.

Even small Infusoria and Diatoms must encounter difficulties before they can reach the ciliated chambers. Great precautions are evidently taken to prevent all solid bodies from entering the canal system, and particularly the ciliated chambers. It is further quite clear that no nourishment can be taken up through the oscula, through which the water is continually flowing out. It seems to me most probable that the food of sponges is dissolved in the water, and that the sponge procures its nourishment from the water in the same way that plants absorb their nourishment from the solutions circulating in the soil.

Now the question arises, which cells perform the function of nutrition—the flat pavement epithelium of the canal-walls, or the collared cells of the ciliated chambers. The collared cells seem, from their situation and structure, best fitted for such a function. But it must be considered that, although none of the higher Cœlenterates possess nephridia, yet the ciliated chambers resemble kidneys so closely that it is not impossible they really are such. They can hardly have to perform the combined functions of segregating urea and of taking up nourishment. If we consider the chambers as nephridia we must assume that the flat, pavement-epithelium, and particularly the ectodermal clothing of the inhalent canals, performs the function of taking up nourishment. My own observations have brought me to this

conclusion. That nourishment can be taken up by indifferent ectoderm cells is shown by the tapeworm, which may be here used in illustration on account of its highly-developed nephridia.

The most probable explanation of the functions of the epithelia of sponges seems to me to be the following:—A constant current of water passes through the sponge. At the entrance to the canal system there are numerous inhalent pores, which are covered by very fine sieves; at the opposite end a few large oscula, through which the water is expelled, are observed. If the sponge fed on solid substances floating in the water the current would of course enter by the wide open oscula, and would be ejected through the small pores. Many experiments have shown that the water invariably enters through the small pores and passes out through the oscula. At the entrance to the ciliated chambers there is a further filtering arrangement, and the water current, caused by the movements of the cilia in the whole canal system, is here impeded. The water in the inhalent canals, outside the ciliated chambers, is consequently under slightly higher pressure and enters the canal-epithelium; here the substances necessary for the life of the sponge are taken up. Behind the pores which lead into the ciliated chambers—that is to say, in the chambers themselves—there is a lower pressure, in consequence of the increase in width of the canals towards the osculum. This facilitates the secretory function of the collared cells. As the sponge does not take up any solid substances there are no faeces, and the expulsion of useless substances devolves on the ciliated chambers. The epithelium of the inhalent canals is probably also respiratory in function. In this case the inhalent canals would represent digestive and respiratory organs, and the ciliated chambers nephridia.

As the process of nourishment is carried on endosmotically, a great quantity of useless material is probably absorbed together with the nutrient substances, and all this, together with the whole of the material oxidised in the sponge, must be extracted and expelled by the cells of the ciliated chambers. This may account for their high development in sponges, just as it accounts for the high development of nephridia in the tapeworm.

Sponges are distinguished from other Cœlenterates by their highly developed mesoderm, and the degree of differentiation attained by its elements. Whilst all the organs of the *Hydro-*

medusæ, Corals, and *Ctenophora* are ectodermal or entodermal, those of the Sponges are mesodermal. In the former the cells of the epithelia are differentiated; the epithelium of sponges is always simple. The muscles, nerves, gland-cells, &c., which we find in sponges are not modified epithelium cells, but differentiated elements of the mesoderm. There is no subepithelium in sponges. The same kinds of cells which we find in the *Epithelialia*, with the exception of the endoblasts, are also found in sponges. But here all cells which do not clothe the surface are of mesodermal origin.

Movements in adult sponges were observed by Aristotle. These movements are performed by cells which are called contractile fibre-cells by F. E. Schulze. They are elongated, spindle-shaped elements, which are mostly found around the pores. I have also found such cells in other parts of the sponge, and Sollas describes similar elements in the sphincters which divide the subdermal cavities of the *Geodidæ* from the inhalent canals.

The skeleton of the Sponges which belong to the order *Cornacusspongiae* appears as a network of fibres, which are composed of series of spicules cemented together by spongin. *Reniera*, *Halichondria*, &c., possess only a very small quantity of spongin. In the *Chalininæ* and *Desmacidonidæ* the number and size of the spicules decreases, and the spicules are replaced by the spongin-cement more and more. In the Horny Sponges the siliceous spicules have disappeared entirely from the supporting skeleton, which consists exclusively of spongin—a substance identical with the cement of the *Halichondria* skeleton. There may be foreign bodies imbedded in the spongin-fibres. The spongin of different *Cornacusspongiae* is not always the same; according to Ridley and Vosmaer it differs in different cases in its behaviour towards polarised light. The colour of the spongin is very variable; the cement of many *Halichondridæ* is hyaline, that of many *Desmacidonidæ* and *Spongidae* light brown, of *Aplysillidae* light orange and sometimes black. The horny fibres of the *Spongeliidæ* appear light yellow and transparent.

The spongin of dry skeletons is, as a rule, darker than that of living sponges or spirit specimens; it is very tough and elastic. According to Krukenberg, the chemical composition of spongin is $C_{30}H_{48}N_9O_{15}$, and is thus similar to that of chitin, conchiolin, and cornein. Spongin is dissolved by boiling acids, and,

according to Passelt, is decomposed when heated in air without first becoming sticky. My own experiments show that it becomes soft and sticky in superheated water (200°).

The spongin always appears in layers. It surrounds in concentric layers, of different refracting powers, the spicule-bundles of *Halichondridæ*, as it does also the axial thread or pith cylinder of Horn Sponges. It is secreted by gland-cells. These elements are pear-shaped, and similar to the gland-cells of the skin; the protoplasm is dense and granular, the nucleus large and spherical. The cells are attached by a slender peduncle to the surface of the fibre, they are pretty closely packed, and form a more or less continuous mantle investing the growing parts of the skeleton fibres. These cells have been termed "spongoblasts" by their discoverer, F. E. Schulze. They occur only on those parts of the fibrous skeleton which are still growing, and disappear as soon as the fibres attain their full size. The solid reticulate skeleton of the *Spongidae*, known to everyone as the Bath Sponge, consists of a few thick, radial, so-called main fibres, between which a fine network of connecting fibres is spread out. In all the fibres we can distinguish an axial thread which consists of a granular substance, and which is surrounded by spongin. At the joining points of the fibres we see that the layers are not continuous, and that all the axial threads are not in connection with each other. The main fibres grow principally at the ends in length, and afterwards in thickness; the connecting fibres rapidly reach their full thickness, and do not grow in length at all. The axial threads, on the surface of which the spongin is precipitated, form a network, but they are in no connection with the axial threads of the main fibres. In the latter, foreign bodies are often found which are used by the sponge as material to build up its own skeleton, and which are cemented together with spongin. They are selected from the bodies which accidentally fall on the surface of the sponge, chiefly sand-grains, Foraminifera-shells, and siliceous spicules of other sponges.

Spermatozoa and ova are observed in sponges. The spermatozoa possess rounded or sharp-pointed, slender heads. They are formed by the continued fission of spherical mesoderm cells, derived from amoeboid wandering cells. In the Calcareous Sponges these cells divide first into two—a sperm mother-cell and a covering cell. By continued division the spermatozoa

are formed from the former; the latter does not change, and surrounds the ripening sperm-ball. The mature spermatophores are often found in the walls of the ciliated chambers. In the Silicea no such structures are observed. The sperm mother-cells form by continued division sperm-balls without covering cell. The spermatozoa lie radially in the extended wall of the sperm mother-cell. In *Aplysilla* and many other sponges the sperm-balls accumulate in certain parts of the body, particularly in the trabeculae and membranes, which are spread out in the basal or central lacunæ. They are often surrounded by a peculiar endothelium, clothing the cavities in which they are contained. This endothelium consists of irregular, flat cells, which lie in several layers one over the other. Farther outward these cells become more irregular, and appear to be separated by layers of intercellular substance, becoming very similar to the common connective-tissue cells. At the time of ripening, the spermatozoa pass into the canals and swarm out through them.

The ova are also derived from wandering cells. As they mature, they lose their mobility, increase in size, and become spherical, while the nucleus increases in size. The ripe ova are destitute of a thick cell-wall, and lie scattered or in groups in the mesodermal ground substance. They are often surrounded by endothelial capsules similar to those of the sperm-balls. In some cases the ovum appears to be attached by a special peduncle—a differentiated endothelial cell—to the capsule.

In the hermaphroditic sponges the ova and spermatozoa, to prevent self-fertilisation, do not mature at the same time. They are fructified within the body of the mother, where the first stages of development take place.

The most interesting and the least known organ system in sponges is their nervous system. The first person who pointed out that the sponges were sensitive was no other than Aristotle. A few years ago Prof. Stewart demonstrated Palpocils of *Grantia* at a meeting of the Royal Microscopical Society, but did not publish a description of them at the time. Subsequently I described certain elements in Calcareous Sponges, which I considered as nervous elements, and since then I have found similar sensitive cells in a number of species belonging to various groups.

Recently also Prof. Stewart has published a figure of his Palpocils, and as he has courteously allowed me to examine his

slides, I can now sum up our knowledge on this subject as follows:— In the circumference of the inhalent pores, or scattered irregularly over the outer surface, or in the membranes which traverse the lacunar cavities in the interior of the sponge, or also round the pores in the cribriform plates which cover the pseudosecula of certain tubular species, nerve-cells are found. They are rarely single, much more frequently in groups of from three to six. In *Grantia* high and slender conical processes are found on the outer surface. In the widened basal portion of these, oval cells are situated from which irregular processes radiate. One of these processes is much larger than all the others, and extends upwards in the form of a fine thread to the distal end of the organ. The other processes of the cell extend downwards. In each organ several such cells are found. These organs are the Palpocils of Stewart, who, not noticing the fact that they are polycellular, gave them that name. Possessing this extraordinary and most important peculiarity, I have termed them Synocils. It is remarkable that these structures have escaped observation hitherto, but it appears highly probable that the sponge has the power of retracting them, so that they are visible only under exceptionally favourable circumstances. It is very likely that the groups of cells previously observed by me, and described as sensitive, are nothing else than retracted Synocils.

The nervous system appears to be most highly developed in *Euspongia canaliculata*, where continuous zones of nervous tissue — sensitive cells above and ganglion cells below — are observed surrounding certain lacunose areas below the surface.

The collections made during the voyages of the 'Alert' and 'Challenger,' as well as my own labours in the Australian Seas, have extended our knowledge of the geographical distribution of sponges so that we are now able to form a general idea of it. Sponges occur in all seas. Those living at great depths are mostly cosmopolitan, while those which occur in shallow water are very different in various localities. The Tropical and Polar zones possess not nearly so rich a sponge fauna as the Temperate zone.

Besides thirteen families of *Hexactinellida* and *Lithistida*, which, being deep-sea sponges, are mostly cosmopolitan, there are thirty-three families of marine sponges which live mostly in shallow water, the distribution of which I will discuss. Of these, twenty-five are cosmopolitan, two occur in the North Atlantic, and

six in the Australian Seas only. The number of cosmopolitan genera is about twelve: 90 per cent. of the genera are limited to small districts.

The Australian Seas are the richest in peculiar genera and families, principally belonging to those groups which we consider as the most highly developed. Of the *Calcispongiæ*, the *Teichonidæ* and *Sylleibidæ* are confined to Australia, and the *Leuconidæ* are very plentiful. In the same way the highest *Chondrospongiæ*, the *Tethydæ*, are represented in the Australian Seas by seven genera, whilst from all other parts of the globe only three genera are known. The number of species of Australian *Chondrosidæ* and *Chondrillidæ* is likewise greater than from other parts. The *Keratosa*, the most highly developed *Cornacuspontigæ*, are represented by thirty-three genera, with more than two hundred species, in the Australian Seas; whilst only nine genera, with about fifty species, are known from other parts of the globe. The lower forms of *Cornacuspontigæ* are distributed pretty equally.

The *Ectyoninæ* and *Chalininæ*, which are rich in spongin, are prevalent in the Australian Seas; whilst the *Esperellinæ*, which possess very little spongin, are rare. The latter, as well as the *Choristidæ* and *Suberitidæ*, are most abundant in the North Atlantic Ocean. Australia, the land-fauna of which appears an age behind that of other continents, harbours on its shores the most highly developed sponge-fauna.

The localisation of the different groups of marine sponges appears particularly remarkable, considering that the fresh-water sponges are more or less cosmopolitan. The family *Spongillidæ* is represented in all quarters of the globe, and the common English fresh-water sponge, or very insignificant varieties of it, occurs everywhere. This is particularly remarkable in the case of Australia. Whilst the marine sponges on its coast are entirely different from those of the North Atlantic, the fresh-water sponges found in the isolated rivers of Australia are the same or very similar to those of our English streams, although the physical conditions are as different as they can be. This shows that the continued inbreeding of the fresh-water sponges caused by their isolation destroys their variability, whilst the continued hybridisation of the marine sponges causes a continual renewal of their variability, and further demonstrates that the efficient cause of the variability of species must be sought in their hybridisation.

NOTES AND QUERIES.

Death of Mr. John Gatcombe.—As an old contributor to this Journal the name of Mr. John Gatcombe, of Plymouth, will be familiar to our readers, and we regret to have to announce his death, which took place, at the age of 68, on the 28th April last. He was born at Knowle, in Somersetshire, but spent the greater part of his life at Plymouth. As might be inferred from the notes which he contributed from time to time to these pages, Mr. Gatcombe was a naturalist who delighted in the out-door observation of the habits of birds, and his intimate acquaintance with a large number of species rendered his notes always reliable. He was once lucky enough to meet with and secure a pair of the Alpine Accentor near Plymouth (Yarrell, i. p. 297). The keen interest which he took in Ornithology made him always willing to assist others with information, and the Editor can recall with gratitude many acts of kindness on his part in helping to clear up doubtful points, especially in connection with the seasonal changes of plumage in sea-birds, to which he had paid considerable attention. Should anyone be found to undertake a work on the Avifauna of Devon, Mr. Gatcombe's scattered notes will be found of material value in its preparation, and their republication in a collected and condensed form would furnish a pleasing memorial of a very worthy naturalist, who in a quiet way continually strove to further the interest of Ornithology in his own county.

MAMMALIA.

Hedgehog attacking a Hare.—A neighbour has recently (April 29th) told me of a strange capture of a Hare. He was crossing one of his fields late in the evening when he heard a Hare crying. He went in the direction, expecting to find one in a trap, but was astonished to come across one attacked by a Hedgehog, which was holding on to one of its hind legs. The Hare, a fully-grown one, seemed paralysed by fear, and allowed itself to be lifted up. Directly the Hedgehog was shaken off it died in my informant's hands, although the injury it had received from the bite of its assailant was but slight. Such a curious fact as this seems worthy of record.—MURRAY A. MATHEW (Stonehall, Wolfscastle, Pembrokeshire).

A Pied Hare.—In January last one of my friends shooting with me here in the big wood killed a Hare which had the whole of one side from nose to rump pure white, and on the other side a patch of white as big as one's hand behind the shoulder. I never before heard of a variety occurring in the woods here, even when they were full of hares and more than 150 were shot in a day. Now, when not more than thirty are killed in a day, the appearance of a variety is more curious.—J. WHITAKER (Rainworth, near Mansfield).

The supposed Serotine in the Newcastle Museum.—In 1884 I communicated to the Norfolk and Norwich Naturalists' Society a list of the Mammalia of the county of Norfolk, and, in instituting a comparison between the various published lists for the eastern portion of England from the Thames to the Tweed, I ventured to express an opinion (like yourself at p. 171 *supra*) that the Serotine mentioned in Messrs. Mennell and Perkins's 'Catalogue of the Mammalia of Northumberland and Durham' as having been killed at Cleadon would prove to be a Noctule. In August of the same year I paid a visit to the Newcastle Museum, and, through the kindness of Mr. J. Hancock, had an opportunity of examining the specimen in question, which proved to be, as you suggest, a Noctule. A note on the subject, contributed by Mr. W. D. Roebuck, will be found in the 'Naturalist' for April, 1885, p. 202. This is, I believe, the first recorded occurrence of the Noctule in the county of Durham, but Mr. Roebuck states that it is a common and widely diffused species throughout Yorkshire. In my notes on this species I find the earliest record I have of its appearance is March (no day), on one occasion only, but in most years about April 20th; whilst in 1871 I saw several on the evening of Sept. 19th; on another occasion others on Oct. 23rd; and in 1872 Mr. Frank Norgate sent me a specimen which he shot at Sparham on Nov. 5th.—T. SOUTHWELL (Norwich). [Some further notes on this subject unavoidably stand over.—ED.]

Reported Occurrence of *Vespertilio murinus* in Dorsetshire.—In your remarks on British Bats (p. 161) I am credited with having noted this species amongst the Bats occurring in Dorsetshire, but I cannot recollect having ever reported it. It has occurred to me, however, that you may have seen *Vespertilio murinus* recorded in my father's remarks on the 'Fauna of Dorsetshire' (first series, vols. 2, 3, and 4). If so, his notes are intended to refer to the Common Pipistrelle. The following I believe to be a correct list of the Bats found in Dorsetshire:—*Vesperugo noctula*, which is common (I found several some years ago in a hole of an old walnut tree); *Vesperugo pipistrellus*, which is also common; *Vespertilio nattereri*; *V. daubentonii* (abundant); *V. mystacinus*; *Plecotus auritus* (not common); *Synotus barbastellus*, also not common, though a few were found in the tower of the church when it was restored in 1875; and lastly *Rhinolophus ferrum-equinum*.—C. W. DALE (Manor House, Glanvilles Wootton).

[The occurrence of *R. ferrum-equinum* in Dorsetshire is mentioned in Bell's 'British Quadrupeds' (2nd ed. 1874, pp. 92, 93), in a communication from Mr. James Salter, who saw several and captured one in the haunted room at Tomson Manor House in September, 1865.—ED.]

Change of Habits in the Brown Rat.—The habits of the Brown Rat in England are sometimes very similar to those which it is said (p. 180) to have assumed in New Zealand. This is especially the case in summer, at

which season it is very fond of taking up its abode by the water side. It then feeds greedily on all the dead fish it can find, thus causing the Otter to be accused of much destruction of which it is not guilty. Pollard willow trees are very favourite abodes of the Brown Rat; I once found the remains of a full-grown Partridge in one of these dwellings. It also frequently makes its nest in thorn fences, not only in low-lying and wet lands, but even on high ground. The Brown Rat can dive and swim very expertly. It is far more common by the water side in summer than in winter, probably finding the water too cold at the latter season.—E. W. H. BLAGG (Cheadle, Staffordshire).

BIRDS.

Nesting of the Stock Dove in East Lothian.—Having been informed by Mr. McDonald, gamekeeper, Hailes, that a pair of Pigeons had taken up their abode among the crags of Traprain Law, and that he was certain that it was not the Ring Dove or the Rock Dove, I suspected it was the Stock Dove (*Columba ænas*). On visiting the spot on April 9th I found my suspicion confirmed. The birds were very shy, but I managed to get a very good view of them. A number of Jackdaws were persecuting them unmercifully. Twice we saw one of the Stock Doves disappear among the rabbit-burrows on the steep face of the hill, and have no doubt that they were breeding there. We climbed up as far as possible, and observed one of them issue from the place where we saw it disappear. I picked up a feather, which I sent to Mr. Evans, of Edinburgh, and he pronounced it to be undoubtedly one of the wing-coverts of the Stock Dove. Mr. McDonald will, so far as he is able, see that the strangers remain unmolested. A specimen—the first obtained in East Lothian—was exhibited by Mr. Evans at a meeting of the Royal Physical Society on March 17th, 1886. It was shot near Longniddry in January, 1886, while feeding in company with a number of Ring Doves. A second specimen was netted, along with Ring Doves, in the same locality on March 5, 1886.—G. Pow (Dunbar, N.B.)

Plumage of the Tufted Duck.—Mr. Macpherson, writing under this heading (p. 112), says, “Perhaps Mr. Whitaker can throw some light on the subject.” I can only say I have often noticed young birds of this species marked with white or dirty white about the face, these markings being usually small white patches at the base of the upper and lower mandibles. Others have the white extending from the bill to the eyes. These markings are invariably lost during the autumn, and are not reassumed till the bird is very much advanced in years, and then only in the females, so far as I have noticed. This marking in old birds must be very rare, as in the many hundreds I have seen I have only noticed it once; and Mr. Hall, who has shot these ducks for fifty years, was very much struck with it, he never having seen one before. I shall (all being well),

during the coming summer and autumn, have the opportunity of seeing a good many of these ducks, and will ascertain the percentage of these varieties. The Tufted Ducks are in full breeding plumage at the end of March, and have a very pleasant note, or number of notes, during the pairing-time. As nearly as I can render them they are "tuc, tuc, tuck; quit, quit, quitta; wheou, whit; quit, quit, quee."—J. WHITAKER (Rainworth, near Mansfield).

Blackcap in Co. Waterford in January.—I can supplement Mr. Ussher's note in the January number of 'The Zoologist' (p. 27). Since January 19th a male Blackcap frequented a garden in the suburbs of Waterford. He came several times daily to a window-sill of the adjacent house for food in the shape of crumbs and scraps of meat, which were spread there for small birds. With these he kept up a constant warfare, and with such success that they forsook the sill which he generally frequented. This bird was found dead on a gravel-path, close to its usual haunts, on February 13th, though there was no appearance of injury of any kind.—J. N. WHITE (Rocklands, Co. Waterford).

Wood Pigeons casting up Pellets.—Referring to Mr. Mann's note under this head (p. 193), I would suggest that probably the Wood Pigeon casts up "pellets" only at certain seasons of the year, *i.e.*, when it has been feeding upon certain kinds of food. A few days ago (May 14th) I found several "castings" of this bird, composed chiefly of the husks of oats. Rooks at this season eject a vast number of "pellets," composed of grain shells, and they never cast up pellets, I believe, when their diet does not consist chiefly of grain, unless possibly they reject the wing-cases of beetles, and other similar substances.—E. W. H. BLAGG (Cheadle, Staffordshire).

A new Egg-drill.—I have forwarded an egg-drill which was made for me by the Dental Manufacturing Company, 6, Lexington Street. I believe they call it a "burr," but it has to be specially made, for in a similar instrument used by dentists the point is not sharp (its use being, I believe, to enlarge cavities for filling). It is certainly far and away the best drill I have ever used, as an infinitesimal amount of pressure is sufficient to make the necessary hole. I may mention, not as an example of any skill on my part, but in commendation of the instrument, that I have bored a moorhen's egg with 175 holes without breaking the egg. I have also had a similar drill made, half an inch in diameter, for embryotomy in large eggs.—HERBERT LANGTON (115, Queen's Road, Brighton).

[We have tested the drill in question, for which we are much obliged, and have found it a very efficient instrument. It is so well balanced that with ordinary care fracture of an egg when drilling it is well-nigh impossible.—ED.]

REPTILES.

Varieties of the Viper.—I have just seen four Vipers, *Pelias berus*, which were killed on the hills in the neighbourhood of Reigate. In three of them the dorsal line was of a brickdust colour, but in one of them it was very nearly black. In all the specimens the ground colour was brownish yellow. The country folks here—and I daresay elsewhere—regard these varieties as distinct species, and call them them the “red” and the “black” adder respectively. The “red adder” is credited with red eyes, and a greater fierceness of disposition and a deadlier poison-fang than the black variety. The difference of colour is also sometimes regarded as indicating a difference of sex, the “black adder” being the male. Is there any ground for this supposition? In the case I have mentioned the “black” specimen was undoubtedly smaller than any of the red ones. A full-grown mouse, perfectly undigested, was found inside the former.” These snakes were killed on account of their fat, for which chemists give—or used to give—five shillings an ounce. The fat is supposed to be a specific not only for adder-bites, but for all wounds and sores.—E. P. LARKEN (Gatton Tower, Reigate).

[If our correspondent would kindly procure some of these varieties, and forward them in “pickle-bottles” filled with spirit, they would be very acceptable for the Natural History Museum, South Kensington.—ED.]

CRUSTACEA.

Axius stirhynchus in Cornwall.—Mr. Fortescue Millett in March last obtained on Marazion beach, from under a stone just above low-water mark, a specimen of *Axius stirhynchus* (a female, in berry), which was placed alive in his aquarium. The occurrence (or rather the observation) of this crustacean on our coast is exceedingly rare.—THOMAS CORNISH (Penzance).

INSECTS.

Practical Entomology at South Kensington.—The Natural History branch of the British Museum in Cromwell Road has just received a most important donation from Lord Walsingham, consisting of a collection of Lepidoptera with their larvæ, mainly British butterflies (*Rhopalocera*) and certain families of moths (*Heterocera*), including *Sphingidæ*, *Bombyces*, *Pseudobombyces*, *Noctuæ*, *Geometridæ*, and *Pyralidæ*. There is also a fine series of Indian species, collected and preserved at Dharamsala, in the Punjab, by the Rev. John H. Hocking, and specimens of Exotic silk-producing Bombyces, in various stages of their development, obtained mostly from Mons. Wailly. With very few exceptions, the British larvæ, which retain a most life-like appearance, and are placed upon models of the plants upon which they feed, have been prepared and mounted by Lord Walsingham

himself; the process adopted having been inflation of the empty skin of the caterpillar by means of a glass tube and india-rubber spray-blower over a spirit-lamp guarded by wire gauze. This has been found a simpler and quicker process, and one admitting of more satisfactory manipulation, than the alternative system of baking by means of heated metal plates or ovens. The specimens have mostly retained their natural colour, but in the case of the bright green species it has been found necessary to introduce a little artificial dry pigment. The whole collection consists of 2540 specimens of larvæ, belonging to 776 species, together with a series of the perfect insects of each species. As continued exposure to light is, unfortunately, most detrimental to the colour of insects, this collection cannot be exhibited permanently: but, for the advantage of those who would like to see it without any restriction, it has been placed in the entrance-hall of the Museum for a period of six weeks, from May 16th to June 25th, so as to include the Whitsuntide holidays and the Jubilee week.

Bees occupying a Bird's Nest.—When taking a walk through some woods near Taunton I came across a nest of the Long-tailed Tit, *Aceredula caudata*, which was quite new, but when I came to look for the entrance I could not find one anywhere; so I removed the top of the nest (which was fully lined with feathers and ready for eggs), and found in the middle a piece of comb about the size of a plum, together with several wild bees. I have not unfrequently found old nests of the Wren occupied by Bees, but I have never before discovered newly-built nests tenanted by them. Has anybody else noticed this unusual habit?—A. H. BUCKLAND (4, East Street, Taunton).

SCIENTIFIC SOCIETIES.

ZOOLOGICAL SOCIETY OF LONDON.

May 3, 1887.—Dr. E. HAMILTON, Vice-President, in the chair.

The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of April, and called attention to two Polar Bears, *Ursus maritimus*, presented by Mr. Joseph Monteith; and to two Crested Ducks, *Anas cristata*, from the Falkland Islands, presented by Mr. F. E. Cobb.

Extracts were read from a letter addressed to the Secretary by Mr. Roland Trimen, respecting the obtaining of a second example of *Laniarius atrocreoecus* in South Africa.

Mr. J. Jenner Weir exhibited and made remarks on a skull of a Boar from New Zealand.

A communication was read from Mr. G. A. Boulenger, containing the description of a new Snake of the genus *Lamprophis*, based on a specimen

living in the Society's Gardens, which had been presented to the collection by the Rev. G. H. R. Fisk.

A communication was read from Mr. J. H. Leech, containing an account of the Diurnal Lepidoptera of Japan and Corea, based on a collection recently made by the author during a recent entomological expedition to those countries. The total number of species in Mr. Leech's list was 155. In Japan Mr. Leech had discovered one new species, *Papilio mikado*, and in Corea four others.

Mr. R. Bowdler Sharpe gave an account of a second collection of birds formed by Mr. L. Wray in the mountains of Perak, Malay Peninsula. This collection contained examples of about fifty species, of which ten were described as new to science.

Mr. H. J. Elwes pointed out the characters of some new species of Diurnal Lepidoptera, specimens of which had been obtained by him during his recent visit to Sikkim.

A communication was read from Mr. Lionel de Nicéville, containing an account of some new or little-known Indian Butterflies.—P. L. SCLATER, Secretary.

ENTOMOLOGICAL SOCIETY OF LONDON.

May 4, 1887.—Dr. D. SHARP, F.Z.S., President, in the chair.

The Rev. C. Ellis-Stevens, B.D., of Brooklyn, New York, U.S.A.; Mr. Frederic Merrifield, of 24, Vernon Terrace, Brighton; Mr. Henry Rowland Brown, B.A., of Oxhey Grove, Staunmore; and Mr. Coryndon Matthews, of Ivybridge, Devon, were elected Fellows.

Mr. Wm. Warren exhibited specimens of *Stigmonota pallifrontana*, *S. internana*, *Asthenia pygmaea* (Hüb.), and *A. abiegana* (Dup.) (*subsequana*, Haw.).

Mr. Stainton remarked that the two last-named species, *Asthenia pygmaea* and *A. abiegana*, both had white underwings, and were in other respects very similar. It was formerly thought that Haworth's *subsequana* was identical with the species previously figured by Hübner as *pygmaea*; but now that the two allied species were critically examined it appeared that the species described by Haworth as *subsequana* was not Hübner's *pygmaea*, but another species known as the *abiegana* of Duponchel, dating only from 1842, so that Haworth's name *subsequana* had priority by 30 years.

Mr. F. Pascoe exhibited a specimen of *Dixines Taylori* (Wath.), taken out of the stem of an orchid—*Saccolabium cæleste*—growing in an orchid-house at Croydon, and received from Moulmein, in Burmah.

Mr. M'Lachlan exhibited nearly two hundred specimens of Neuroptera, in beautiful condition, collected by Mr. E. Meyrick in various parts of Australia and Tasmania, comprising about seventy species. There were between forty and fifty species of Trichoptera, including moth-like forms

from Western Australia, allied to *Plectrotarsus*, Kol.; and other species belonging to a group represented by *Hydropsyche Edwardsii* (M'Lach.). Among the Planipennia the most remarkable insect was a new species of the singular genus *Psychopsis* (Newm.), from Mount Kosciusko, where it was common. Of Pseudo-Neuroptera there was a species of *Embiidae* from Western Australia, and certain curious *Psocidae* and *Perlidae*. The Trichoptera appeared to be exclusively confined to *Sericostomatidae*, *Leptoperidae*, and *Hydropsychidae*. Mr. Meyrick made some remarks on the localities in which he had collected the species.

Mr. M. Jacoby exhibited three specimens of a new species of *Xenarthra*, collected by Mr. G. Lewis in Ceylon; also a species of *Loxoprosopus* from Brazil.

Mr. C. O. Waterhouse exhibited a living example of an Ichneumon—*Ophion macrurum*—bred from a larva of *Callosamia promethea*, a North-American species of *Saturnidae*. He also exhibited a number of wings of Lepidoptera denuded of the scales, in order to show the neuration for study, and explained the method he had adopted for removing the scales. The wings were first dipped in spirit and then placed in *eau de javelle* (potassium hyperchlorite). Mr. Waterhouse said he had sometimes substituted peroxide of hydrogen for *eau de javelle*, but the action was much less rapid, although the results were satisfactory.

Mr. Poulton observed that, although the pigment had disappeared, he thought the scales were not removed, but were merely rendered transparent; and he remarked that the discovery of some chemical for softening chitine had long been wanted to prepare specimens for the microscope. The discussion was continued by Mr. M'Lachlan and Dr. Sharp.

Mr. Slater read a note, extracted from the 'Medical Press,' on the subject of the poison used by certain tribes of African Bushmen in the preparation of their arrows. It was stated that a poison was prepared by them from the entrails of a caterpillar which they called "N'gwa."

The Rev. W. W. Fowler read a note received from Mr. J. Gardner, of Hartlepool, in which it was stated that *Dytiscus marginalis* possessed the power of making a loud buzzing noise like that of a humble bee.

Dr. Sharp said he was familiar with the humming of *Dytiscus marginalis* previous to flight, and thought it might perhaps be connected with an inflation of the body for the purpose of diminishing the specific gravity of the insect; he had noticed also that it was occasionally accompanied by the discharge of fluid from the body.

Mr. Wm. White read a paper "On the occurrence of anomalous spots on Lepidopterous larvæ." A discussion ensued, in which Mr. Poulton, and others took part.

Mr. Waterhouse read "Descriptions of new genera and species of *Buprestidae*."—H. Goss, Hon. Secretary.

